Agenda item 4.6
For information

Council

CNL(07)26

Unreported catches – Tabled by UK (England and Wales)

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Summary

All licence holders must provide the Environment Agency with details of their catch of salmon and migratory trout and the number of days fished on each river or, for nets, each fishery. Catch returns are received from 100% of net and trap licence holders and from ~90% of full season anglers. For rod anglers the proportion of under-reporting is estimated through a catch reminder system and is currently estimated at less than 10%. There are few independent measures of under-reporting in the rod fishery, but these indicate that the level is small. For the net fishery, surveillance techniques have been used and a figure of 8% has been used to adjust for the level of under-reporting. However in certain fisheries the level may been substantially higher in the past, possibly as much as 50%. The illegal catch, by its nature is difficult to quantify. A questionnaire survey of Environment Agency enforcement staff suggests that it is about 12 - 13% of reported (legal) catch.

In the early 1990s the percentage of under-reporting in the rod catch decreased from ~ 50% to ~20% as a result of changes in the licensing and associated catch return system covering England and Wales. Since the mid-1990s, following awareness campaigns and enhanced reminder systems the under-reporting is estimated to have declined to less than 10%. There is little information on the trend in under-reporting for the net fisheries. Whilst not a fully independent and reliable measure, the estimate of illegal catch has reduced from 23 tonnes in 2002 to 14.5 tonnes in 2006. Records of reports and incidents support a declining trend in illegal fishing in the last 10 years.

The calculation of the under-reported catch from anglers comes from an estimate of undeclared catch using the method of Small (1991). For nets-men the main source is through surveillance operations. The estimated illegal catch is derived from enforcement activities.

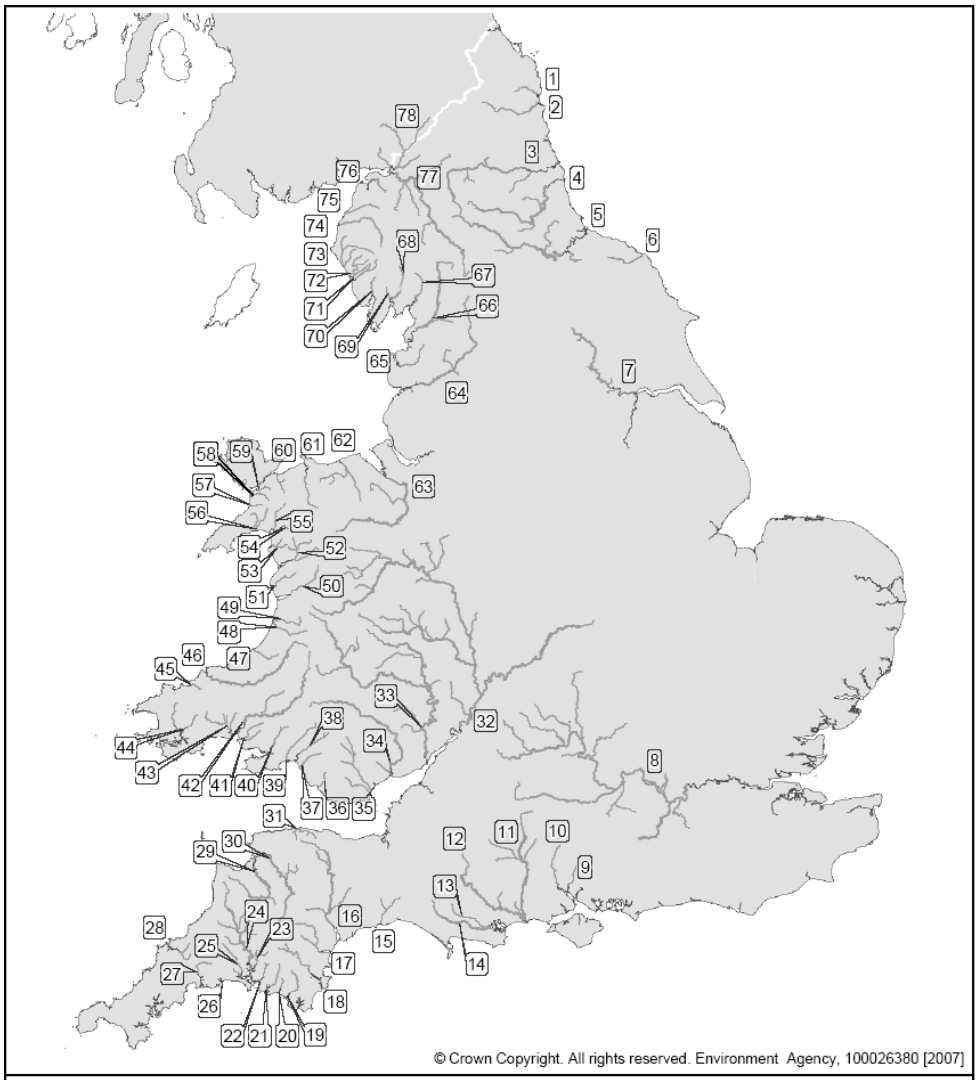
Of the total estimated unreported catch in 2006 (6,698 salmon), over half derived from illegal catch and a quarter from under-reporting in the rod fisheries. Net fisheries were assessed as contributing a minor component (16%).

In order to maintain the low level of under-reporting the Environment Agency issues reminders to anglers that they should record their catch. Awareness-raising efforts are also used to promote the need for, and the value of properly reporting catches. Enforcement action has been used when there have been significant instances of the law requiring reporting of catch having been contravened. Targeted enforcement activity also aims to suppress illegal unreported catch.

There has been progress against the Environment Agency's corporate target, set in 2002, to reduce illegal and unreported catch from 35 tonnes (in 2001) to 25 tonnes by 2008. The level recorded in 2006 was 25 tonnes. Whilst part of this reduction relates to the way in which the estimation of illegal catch (the greater proportion) is linked to reported (legal) catches that have declined, this does also reflect progress in improving catch reporting and reducing illegal fishing.

1. Introduction

There are 78 rivers supporting salmon in England and Wales (Figure 1)



1 Aln
2 Coquet*
3 Tyne*
4 Wear*
5 Tees*
6 Esk (Yorkshire)*
7 Ouse
8 Thames*
9 Itchen*$
10 Test*
11 Avon (Hants)*$
12 Stour (Dorset)*
13 Piddle*
14 Frome*
15 Axe*
16 Exe*
17 Teign*$
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28 Camel*$
29 Torridge*
30 Taw*$
31 Lyn*
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33 Wye*$
34 Usk*$
35 Taff*
36 Ogmore*
37 Afan*
38 Neath
39 Tawe*
40 Loughor*
41 Gwendraeth Fawr
42 Tywi*
43 Taf*
44 E & W Cleddau*
45 Nevern*
46 Teifi*$
47 Aeron
48 Ystwyth
49 Rheidol*
50 Dyfi*
51 Dysynni*
52 Mawddach*$ & Wnion*
53 Artro
54 Dwyryd*
55 Glaslyn*
56 Dwyfach & Dwyfawr*
57 Llyfni
58 Gwyrfai$
59 Seiont*
60 Ogwen*
61 Conwy*
62 Clwyd*
63 Dee*$
64 Ribble*
65 Wyre*
66 Lune*
67 Kent*
68 Leven*
69 Crake*
70 Duddon*
71 Esk (Cumbria)*
72 Irt*
73 Ehen & Calder*$
74 Derwent*$
75 Ellen
76 Wampool
77 Eden*$
78 Esk (Border)*

** River with Salmon Action Plan; $ River designated as a Special Area of Conservation*

Figure 1. Main salmon rivers in England and Wales

1.1 Administrative arrangements

In England and Wales salmon legislation and policy is determined by the Governments, through the Department of Environment, Food and Rural Affairs (Defra) for England and the Welsh Assembly Government for Wales. Delivery of salmon regulation and management is the responsibility of the Environment Agency.

In 2002, the Environment Agency set one of its corporate targets as to reduce the illegal and unreported catch of salmon from 35 to 25 tonnes. In 2006, the estimated total illegal and unreported catch of salmon was 25 tonnes (Anon. 2007). As illegal catch makes up the major part (see Section 4 below) and its calculation is as a proportion of licensed (legal) reported catch (Section 2.3), this reduction from 35 tonnes in 2002 is in part a factor of reducing legal (particularly net) catch. However, it does also reflect successful efforts by the Environment Agency in improving catch reporting and enforcment against illegal fishing.

Byelaws under the Water Resources Act 1991 (see *Appendix 1*) require that all licence holders must provide the Environment Agency with details of their catch of salmon and migratory trout. They must also provide the number of days fished on each river at the end of each year or, for nets, in each fishery monthly.

The Environment Agency came into being in 1996. Until 1992, its predecessor organisation, the National Rivers Authority was divided into 10 regions (Figure 2 below) and each Region employed different systems of licensing and obtaining anglers catch returns for their respective areas. In 1992 a unified licence regime was introduced across England and Wales that allowed anglers to fish for all species. The licensing system was changed again in 1994 with the introduction of separate licences for migratory salmonids and for trout and coarse fish.

Throughout this period, licences for net or trap fishing for salmon and sea trout have been issued specific to each relevant fishery.

Appendix 2 gives examples of the forms now used for anglers and netsmen to report their catches.

The rivers regulated by the Environment Agency and for which salmon catch returns must be made include the River Border Esk, including that part in Scotland, but do not include any part of the River Tweed or its tributaries (see Figure 1).

References in this report to the Environment Agency, for the period before 1996, should be taken also to include its predecessor bodies.

Figure 2. Map of England and Wales showing the 10 administrative regions that operated prior to the formation of the Environment Agency in 1996.

1.2 Catch reporting by anglers

The five year mean (2002-2006) for the proportion of anglers submitting a return is 87.6% for annual licence holders and 53% for short term (1 & 8 day licences) (Anon., 2007). It is known that many anglers who purchase more than one short-term licence during a season combine catch details on a single licence return, and this contributes to the lower return rate for this licence category. Also, in general, short-term licence holders fish less and catch fewer fish than those anglers who hold an annual licence. A detailed analysis of catch return data for 2002 for the Rivers Dee (Fig. 1, river 63) and Tyne (Fig. 1 river 3) indicated that 89% and 86%, respectively, of short-term licence holders making a return declared a nil catch. It also shows, that 98% and 96%, respectively, of the total declared salmon catch for these rivers was made by anglers holding an annual licence. The lower return rates for short-term licence-holders is, therefore expected to have a negligible impact on the declared catch.

1.3 Catch returns by net/trap operators

All net licence holders (321 in 2006) submit a return. Net fisheries operate in a number of estuaries and along some areas of coast and all licence holders are required to make a return to the Environment Agency of the number of salmon and migratory trout caught, their size and the number of days or tides fished.

2. Method used to estimate under-reporting

2.1 Rod catch

The Environment Agency and its predecessor the National Rivers Authority have operated a unified rod catch return system across England and Wales since 1995. The method used to estimate the under-reporting of rod caught salmon is presented in *Appendix 3*. The method utilises a catch reminder system which uses the differences in catch rate between unprompted and prompted returns (Small, 1991).

The first national catch reminder was issued to anglers (regardless of whether a return had already been made) in January 1995, in respect of the 1994 season. For 1995, the reminder was brought forward to November, closer to the end of the fishing season in most regions. The reporting and reminder system has been subject to a number of difficulties, not least the problem of collating licence counterfoils from over 17,000 outlets and inputting details onto a database in time for the November reminder. In 2001, improvements to the database enabled more effective targeting of reminders. (See *Appendix 4* for details of changes to the system of rod licence sales and catch return distribution.)

These improvements also made possible the issue of a second reminder (sent to all anglers who had not sent in a return by January), in line with NASCO recommendations, in order to reduce the level of unreported catch. This was undertaken nation-wide for the first time early in 2002, in respect of catches for the 2001 season, and has continued in 2003–2006. In 2005 a further improvement resulted from the electronic issuing of licences. This provided a more up-to-date and accurate database for issuing reminders. *Appendix 5* shows a recent example of a reminder letter.

2.1.1 Comparison between national returns and records collated by fishing clubs and/or fishery owners.

Comparisons between catch returns made by anglers to the Environment Agency with those reported to their club on particular rivers has been possible on a few rivers.

River Dyfi

On the Dyfi (Fig. 1, river 50) returns to the New Dyfi Fisheries Association, which accounts for ~ 95% of the declared catch were available for the period 1966 to 2003. In the early part of the time period there was considerable difference in the number of salmon reported caught to the New Dyfi Fisheries Association compared with the Environment Agency (Figure 3). The difference decreased steadily over time such that by 2002 there was close agreement between the two.

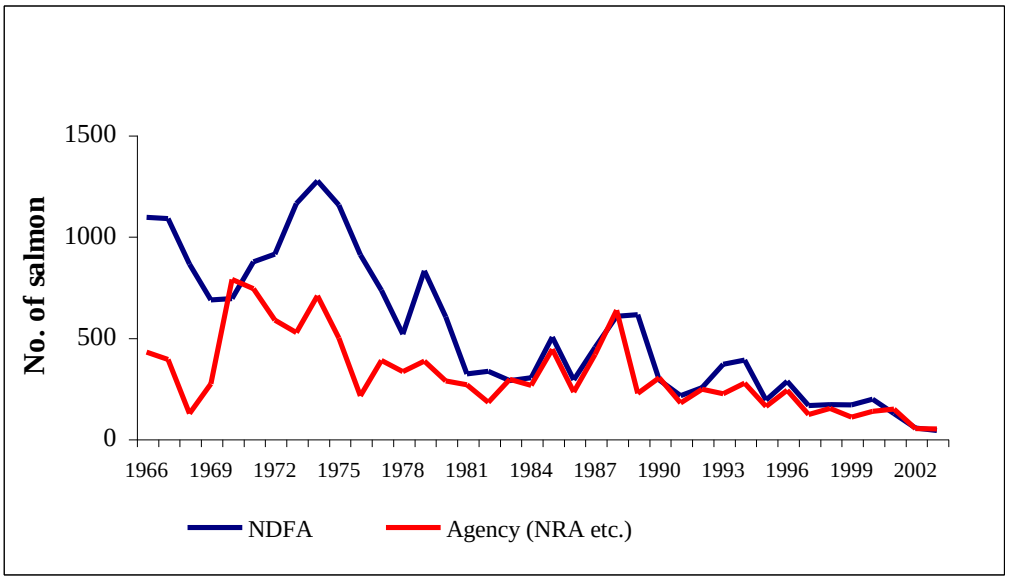


Figure 3. A comparison of reported rod catch on the River Dyfi to the New Dyfi Fisheries Association (NDFA) and to the Environment Agency (Agency) between 1966 and 2003.

River Teifi

On the River Teifi (Fig. 1, river 46) data were available over a similar time period from Teifi Trout Association and Llandysul A.C which accounts for ~ 99% of the salmon fishery of the Teifi. The pattern of catches reported to the angling club and Environment Agency are similar (Figure 4), and for most of the time period the returns made to the Environment Agency were higher.

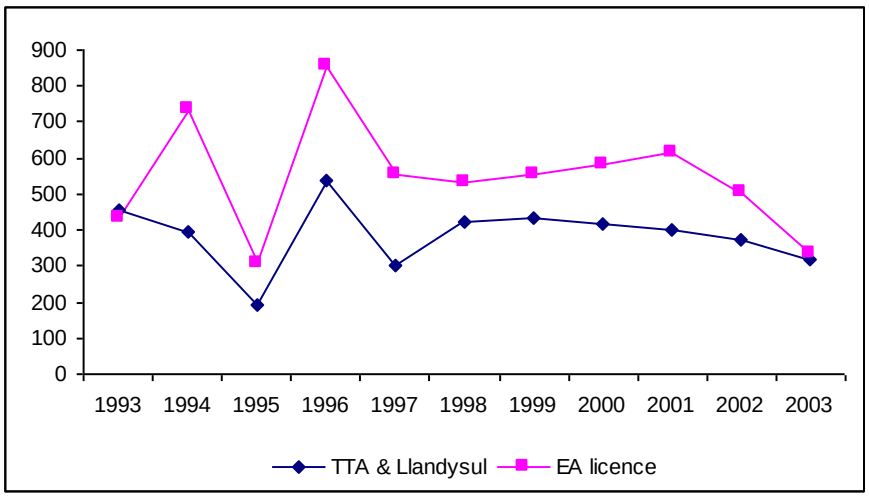


Figure 4. A comparison of reported rod catch on the River Teifi to the Teifi Trout Association and Llandysul A.C (TTA & LLandysul) and to the Environment Agency (EA licence) between 1993 and 2003.

River Derwent

On the River Derwent (Fig. 1, river 74) in 2002, 795 salmon were reported caught to Castle Fisheries, which accounts for ~ 90% of the fishing effort and catch on the Derwent. In the same year, 888 salmon were reported caught to the Environment Agency.

River Tamar

On the River Tamar (Fig. 1, river 24) in 2003, the Tamar River Association recorded the salmon catch from the river as 135 salmon. In comparison 114 salmon (84%) were reported to the Agency. If a 10% under-reporting in the Environment Agency returns is assumed then the total catch for the Tamar is assumed to be 125 salmon, 93% of the Tamar Fisheries Association estimate.

Though the data set is small the indications are that the level of under-reporting of rod caught salmon to the Environment Agency is small.

2.2 Net catch

For the net fishery, surveillance techniques have been used to estimate the level of under-reporting.

The rate of under-reporting for net fisheries is generally considered to be low in most fisheries of England and Wales and a figure of 8% has been used to adjust for the level of under-reporting of the net catch in recent years, based on the best available information. Opinions on the level of under-reporting in net fisheries in England and Wales collected from Environment Agency regional fisheries personnel in February 1998 were in the range 0% to 15%. In the North East, under-reporting in the coastal fishery has previously been estimated at about 7% (Anon., 1991). In the North West, comparison of the catches seen by the bailiff with those declared for that day, suggested that catches in the estuary net fishery on the River Lune (Fig. 1, river 66) were under-reported by around 8%. However, in the Solway Estuary (Fig. 1, rivers 77 & 78) a surveillance operation throughout July and August 2004 linked observed daily catches of salmon and sea trout caught by identified haaf nets-men to the returns they subsequently submitted to the Environment Agency. Assessment suggests that the fishery has been declaring only 50% of its catch. Failure to make a return of catches is an offence and 18 nets-men were prosecuted in 2005 and penalised by the court. Reporting in this fishery is believed to have improved significantly from 2005.

2.3 Illegal catch by unlicensed fishermen

By their nature, illegal catches are very difficult to quantify. However, assessments can be made on the basis of enforcement activities. Consultation with Environment Agency regional fisheries personnel was used as the basis for an assessment in February 1998, which provided estimates of illegal catches in coastal waters and within rivers and estuaries. These ranged from 5% to 18% of the declared catch for different regions.

These estimates were reviewed in 2003 through a questionnaire sent to Environment Agency regional fisheries personnel, as in 1998, asking them whether they agreed with the current estimate or to provide a revised estimate together with any justification for their decision (*Appendix 6*). The results indicated a similar overall level of illegal catches between 12 and 13%, though regional estimates ranged from 5% (Southern Region, with no licensed commercial catch) to 24% (North West Region, with 15% of the national reported catch). The catches of salmon in the North East, South West and Thames tended to arise as by-catch taken by nets legitimately targeting bass and other marine species, although in-river poaching was reported to be an ongoing problem in many areas, driven partly by the premium prices paid for wild salmon.

There are no commercial salmon fisheries in the Thames or Thames Estuary, but a questionnaire survey of nets-men fishing for marine species in 2003 indicated a possible by-catch of over 100 salmon that year (Anon. 2007). Investigations in 2006 suggest that this catch is likely to be very variable and was estimated at only 20 to 30 fish in that year.

It is recognised that the use of a national average might not be entirely appropriate given the variation apparent in the Regional estimates and the proportion of the England and Wales catch declared by each Region. However, pending further refinement of this analysis, a value of 12% of declared catch is currently applied (as in all years since 1998) to estimate the total illegal catch for England and Wales.

3. Trend in under-reporting

3.1 Rod catch

Between 1986-1991: Until 1992, the 10 different regions of the National Rivers Authority (NRA) (Figure 2) employed different systems of licensing and obtaining anglers catch returns for their respective areas. Different correction factors should therefore be applied in different regions during this period.

Region	Return rate from anglers (%)	Prop. of catch declared	Suggested correction factor
Northumbria	30-40	0.64	1.56
Yorkshire	85-100	0.97	1.03
Southern	100 (General Licence)	1.00	None
Wessex	65-80	0.91	1.10
South West	45-50	0.77	1.30
Severn Trent	65-85	0.91	1.10
Welsh	60-65	0.83	1.20
North West	20-30 (1986-90)	0.50	2.00
North West	70 (1991)	0.88	1.13

Between 1992-1993: In 1992 a unified rod licence for England and Wales was introduced. For these two years there was no separate salmon licence, so the number of salmon anglers is more difficult to estimate than usual. Due to the low licence

price, the number of anglers who fished for salmon is thought to have been substantially greater. Also it was impossible to send a catch reminder so the return rate was very poor. It is suggested that just over 50% of the salmon catch was declared to the NRA in 1992 and 1993.

	Return rate (%)	Prop. of catch declared	Suggested correction factor
National	20-30	0.53	1.90

Between 1994-1995: With the introduction of a separate migratory salmonid licence in 1994, a catch return reminder became possible and was introduced. Catch return rates increased three-fold and the accuracy of catch returns substantially improved.

	Return rate (%)	Prop. of catch declared	Suggested correction factor
National	71-76	0.91	1.10

1996-present: The system of collecting declared catch has not changed since 1994. It is believed that return rates are not significantly different from the period 1994-1995 so the same suggested correction factor of 1.10 is applied.

Trend, 1992-present: In terms of changes over time in under-reporting, the estimate for the first two years of the national licence (1992-93) was 47% decreasing to 9% for the period from 1994 to present.

The assessments of salmon stocks reported to ICES incorporate the use of correction factors for rod catches as set out above.

3.2 Net catch

There is little information on the trend in under-reporting for the net fishery. In the Solway Estuary, the surveillance and enforcement effort by the Environment Agency in 2004 reduced under-reporting from that time.

3.3 Illegal catch

The estimate of illegal catch has reduced in recent years (from 23 tonnes in 2002 to 14.5 tonnes in 2006). However, to a significant extent, this is an artefact of this measure being determined as a proportion of reported catch that has reduced, including through the decline in the catch in licensed net fisheries.

Figures 5 and 6 below show the annual numbers of reported illegal fishing incidents in Wales (Fig. 1, rivers 32 to 63) and North East England (Fig. 1, rivers 1 to 5) respectively. These suggest a declining trend in the amount of detected illegal fishing and so, potentially also in illegal catch.

Figure 5. Trend in cases of illegal fishing recorded in Wales

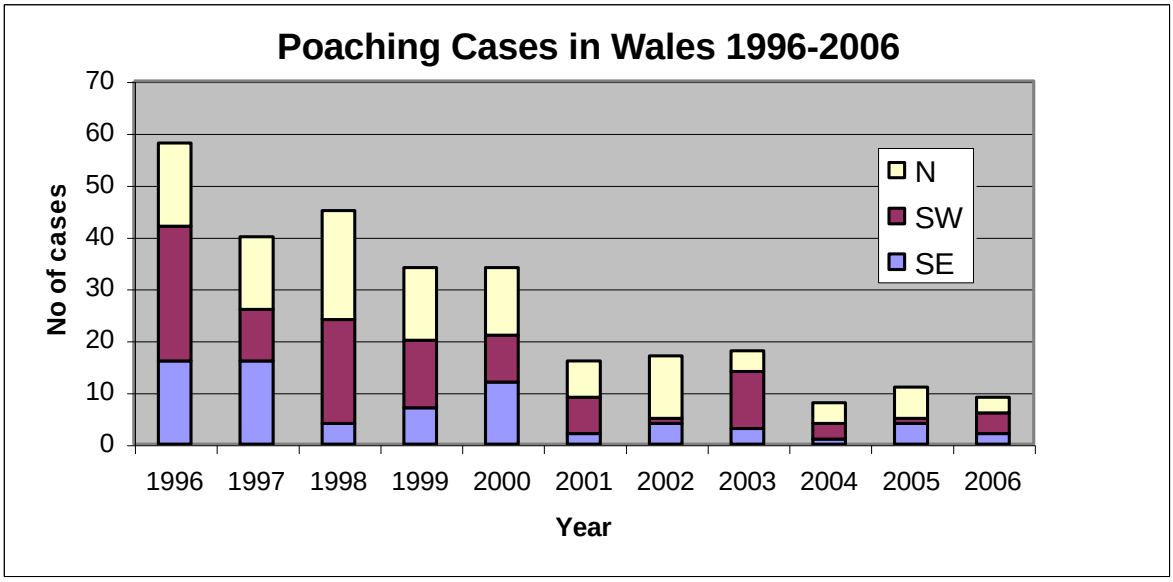
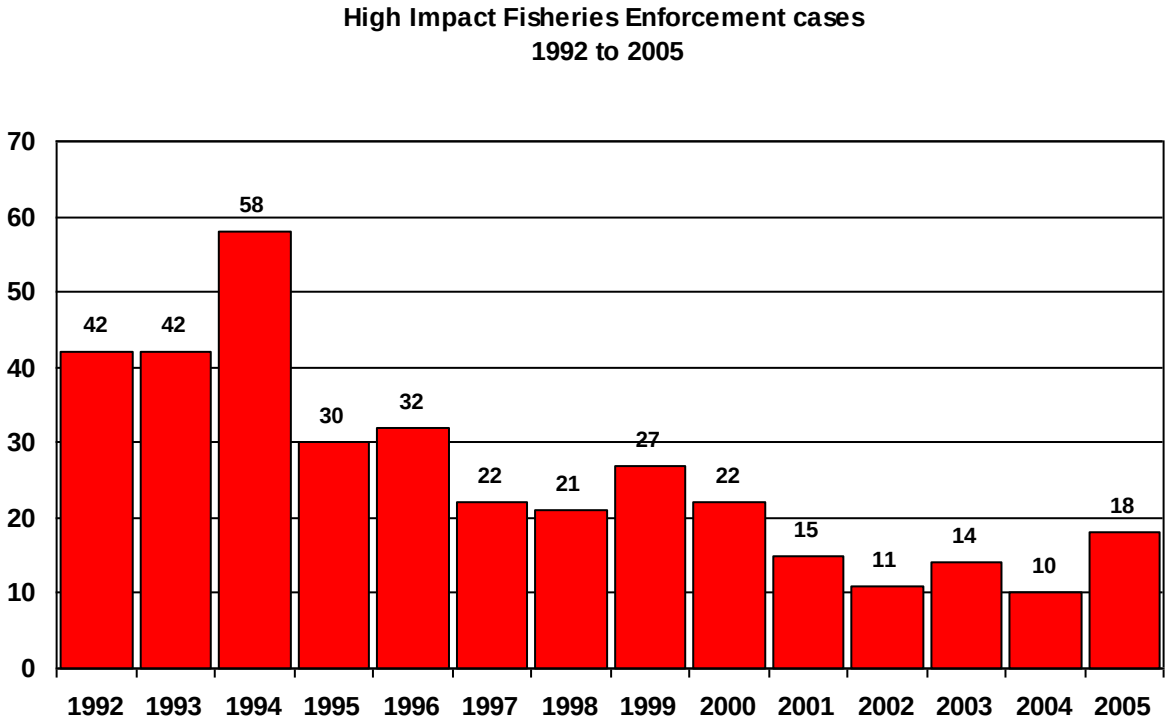


Figure 6. Trend in reports of illegal fishing in Northumbria, North East England



4. The source of the unreported catches

The derivations of the under-reported catch from anglers are from an estimate of undeclared catch using the method of Small (1991), for netsmen through surveillance operations, and the estimated illegal catch is derived from enforcement activities.

The overall contributions to estimated levels of unreported catch for 2006 were as follows.

Source	Estimated number of salmon not reported	Proportion(%) of total England & Wales reported catch	Proportion (%) of total estimated unreported catch
Rod catch contribution	1707	5.2	25.5
Net catch contribution	1086	3.3	16.2
Estimated illegal catch	3905	12.0	58.3
Total	6698		100

Of the total estimated unreported catch in 2006 (6,698 salmon), over half derived from illegal catch and a quarter from under-reporting in the rod fisheries. Net fisheries were assessed as contributing the minor component of 16%.

5. The measures being used or planned to minimise unreported catches

In order to maintain the low level of under-reporting, the Environment Agency annually reviews the rod licence reminder system and methods used to assess the undeclared net catch to see where they can be improved.

Opportunities are also identified to remind anglers and nets-men that they should record and report their catch. These include use of press articles (an example is shown in *Appendix 7*), presentations at relevant events and discussions in fishery group meetings. The option is available of enforcement action against contravention of the legal requirement to report catch as shown in the example of the Solway haaf net fishery in 2004.

The Environment Agency undertakes targeted enforcement of fisheries to ensure illegal catch is minimised. Each management unit sets out an annual plan for its fisheries enforcement. Activities include intelligence gathering, targeted surveillance, incident response and inspections of licensed fisheries and premises that deal in salmon. 200 officers are warranted to enforce relevant fisheries laws. Between 15 and 25 individuals were prosecuted by the Environment Agency for offences involving salmon poaching in each of the last three years.

The Governments in England and Wales are working to improve fisheries laws to support better regulation and enforcement. One intended effect is to prevent the selling of rod-caught salmon that should help further suppress illegal and unreported catch.

References

Anon. 1991. Salmon Net Fisheries: Report of a review of salmon net fishing in the areas of the Yorkshire and Northumbia regions of the National Rivers Authority and the salmon fishery districts from the River Tweed to the River Ugie. MAFF and Scottish Office, 224 pp.

Anon. 2007. Salmon stocks and fisheries in England and Wales, 2006. Preliminary assessment prepared for ICES, April 2007. Environment Agency & Cefas, 100 pp.

Small, I. (1991). Exploring data provided by angling for salmonids in the British Isles. In: I.G.Cowx (ed.) Catch effort sampling strategies. Their application in freshwater fisheries management. Oxford: Fishing News Books, pp 81-91.

Appendices (attached)

Appendix 1	Byelaw; Reporting of salmon and sea trout catch in England and Wales
Appendix 2	Examples of forms used to report catches in England and Wales
Appendix 3	Method of correction for Rod Catches in England and Wales
Appendix 4	Resume of changes to Environment Agency rod licence sales and salmon catch returns systems
Appendix 5	Example reminder letter
Appendix 6	A review of the estimate currently used to determine the illegal salmon catch for England and Wales
Appendix 7	Example press article (Trout and Salmon Magazine, December 2005) promoting catch reporting

Environment Agency **May 2007**

Appendix 1

Byelaw; Reporting of salmon and sea trout catch in England and Wales

RETURNS TO BE MADE

NATIONAL

3. Migratory Salmonid Catch Returns

(1) Any person to whom a licence is issued by the Agency to fish by rod and line for salmon or migratory trout shall not later than the 1st day of January in the following year, make a return on a form provided by the Agency giving particulars of dates, the locations and the time spent fishing and the number and weight of any salmon or migratory trout caught (except in relation to small sea trout (500 g or less) where only the number caught need be returned) including those returned alive giving details of whether they were caught on fly, spinner or bait, or a statement that no salmon or migratory trout were caught by the licence holder.

(2) Any person to whom a licence is issued by the Agency to fish with any instrument other than rod and line for salmon or migratory trout shall within 7 days of the end of each month during the fishing season make a return on a form provided by the Agency giving particulars of dates, the locations and the time spent fishing and the number and individual or aggregate weight of any salmon or migratory trout caught by each instrument, or a statement that no salmon or migratory trout were caught by the licence holder or his agents.

(Confirmed 18 December 1996)

Appendix 2

Examples of forms used to report catches in England and Wales

A. For rod fishing

ENVIRONMENT AGENCY

No. SWH72400667

2006 CATCH RETURN

If you have not yet made a return, could you please **complete Parts 1, 2 and 3** of this form, tear it off, insert the completed return in the pre-addressed FREEPOST envelope provided, and post it. **No stamp is required – the postage is paid.**

- **Your fishing effort is important, even if you didn't catch anything.** If you didn't fish – please say so in Part 1
- Please don't forget to record any salmon or sea trout you have released, other than kelts. If weight not known, please indicate an estimate.

Part 1 records details of your fishing effort - please give the river name, nearest town and County in which you were fishing. Please record your effort even if you had a 'nil' catch. Please show the number of days you fished for salmon or sea trout.

Main River Name	Nearest Town	County	Number of days fished for Salmon or Sea Trout	
			Before 16 June	After 15 June
Example Wyexe	Newbridge	Midshire	5	8
LUNE	HALTON	LANCS	0	10

Part 2 If you took a large catch of small sea trout (1lb or less) please show them all together here, separating the catch by month, otherwise please use part 3.

Month	Main River	County	Show no. of small sea trout caught by each method			Fish released (Numbers)
			Fly	Spinner	Bait	
Example June	Wyexe	Midshire	3	7	5	14

Part 3 please record details of each fish landed (one per line please) including whether it was returned or not. Large catches of small sea trout (1 lb or less), should be recorded in **Part 2 only**. If you did not catch any fish please write 'nil' below.

Date of capture		River (Give name of main river only and the county where you fished)		Species (Please tick)		Weight		Method of Capture (Please tick)			Fish released (✓)
Day	Month	Main River	County	Salmon and Grilse	Sea Trout (Sewin)	lbs	ozs	Fly	Spinner	Bait	
Example 31	4	Wyexe	Midshire	✓		15	8		✓		✓
16	10	LUNE	LANES	✓		6	5		✓		
18	10	LUNE	LANES	✓		8	0			✓	✓
18	10	"	"	✓		7	0			✓	✓
18	10	"	"	✓		10	8			✓	✓

Please continue on a separate sheet of paper if necessary.

B. For net/trap fishing

ENVIRONMENT AGENCY

SALMON AND SEA TROUT CATCH RETURN
COMMERCIAL FISHERY

NAME: ..... LICENCE No.: | | | | | | | | AREA OR RIVER FISHED: .....

MONTH: ..... YEAR: ..... TYPE OF GEAR USED: .....

Date	No of Tides Fished	SALMON No of Fish caught in each weight group (lbs)																		SEA TROUT No of Fish caught in each weight group (lbs)									
		< 3 lbs	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20lbs and over	½	1	1½	2	3	4	5	6	7	8	8lbs and over
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Appendix 3

Method of correction for Rod Catches in England and Wales (*Taken from Small, 1991*).

The total catch from licence returns is recorded and a simple multiplier applied to this number to give an estimate of the catch from all licences.

$$\text{Multiplier} = \frac{\text{Total licences x M}}{\text{Total returns x Mu}} = \frac{\text{Licences x catch/licence}}{\text{Returns x catch/return}} = \frac{C}{Cu}$$

Or it can be written as

$$C/Cu = 1/Pu \times M/Mu \qquad (1)$$

The number of licences sold and the numbers of returns made are known and therefore catch per return can be calculated. Catch per total licences sold is unknown. We cannot assume that these two catch rates are the same since the anglers that make a return are more likely to have higher catches. Therefore need to find this unknown.

The estimated total number of fish caught in a defined period of time is:

$N = (Pu\ Mu) + (Pp\ Mp) + (Pm\ Mm)$

Where Pu = unprompted returns
Mu = Average CPUE from unprompted returns
Pp = Prompted returns
Mp = Average CPUE from prompted returns
Pm = Missing returns
Mm = Average CPUE from missing returns.

To estimate M, Mm must first be estimated

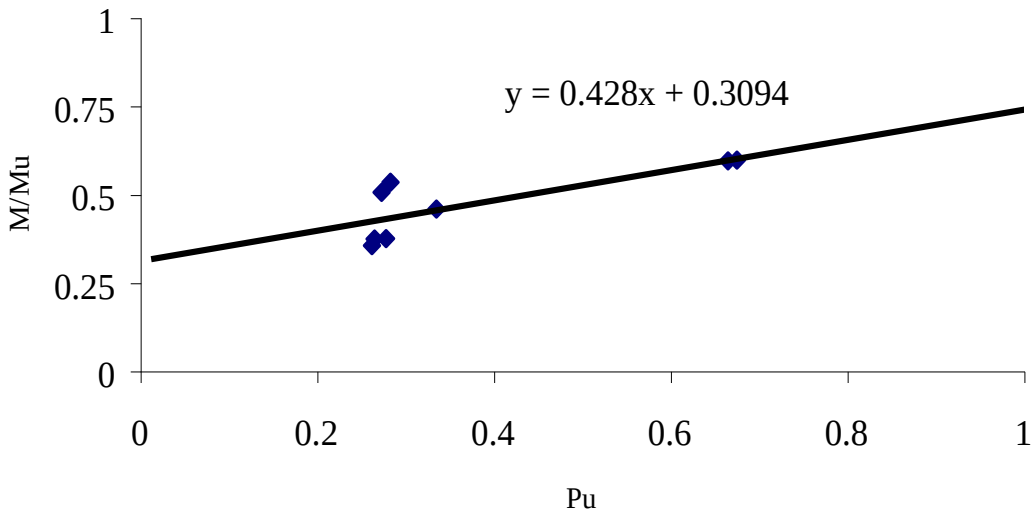
Looked at studies with a reminder system in place WWA and SWWA.

		Proportion of N			Average Catch Rates			Assumption 1	
	Year	Pu	Pp	Pm	Mu	Mp	Mp/Mu	Mm	M/Mu
WWA	1977	0.266	0.358	0.376	0.802	0.191	0.238	0.045	0.372
	1978	0.263	0.329	0.408	0.734	0.158	0.216	0.034	0.353
	1979	0.274	0.265	0.461	0.567	0.264	0.474	0.128	0.504
	1980	0.279	0.338	0.383	0.852	0.190	0.223	0.042	0.373
	1981	0.336	0.282	0.382	0.627	0.189	0.301	0.057	0.456
	1982	0.284	0.353	0.363	0.558	0.264	0.473	0.125	0.532
SWWA	1980	0.593	0.267	0.140	1.865	0.455	0.244	0.111	0.666
	1981	0.595	0.227	0.178	1.665	0.485	0.291	0.141	0.676

Mm is the only unknown and it is assumed that the ratio of Mu:Mp is the same as Mp: Mm.
Therefore Mm = Mp/Mu x Mp.

M/Mu is then plotted against Pu for each of the datasets where a reminder system exists.

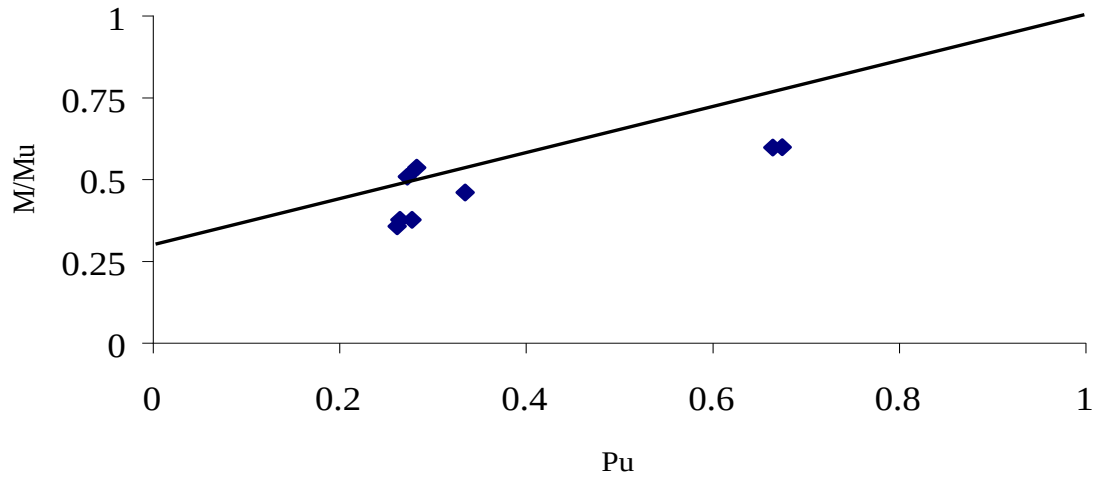
The relationship fitted can be quadratic or linear. For the Environment Agency reporting rates, a linear relationship is fitted, taken from Small 1988. From the data containing reminder systems, it can be seen that the intercept of the M/Mu axis is approximately 0.3.



If 100% returns are received unprompted then M/Mu must equal 1, so the line must proceed from 0.3 up to 1 and that gradient is 1-0.3 = 0.7.
The equation of this is then:

M/Mu = Y + (1-Y) x Pu

M/Mu = 0.3 + (1-0.3) x Pu



And so from equation 1,

C/Cu = 1/Pu x M/Mu
Where M/Mu = Y + (1-Y) xPu

C/Cu = 1/Pu x Y + (1-Y) xPU

C/Cu = Y/Pu + (1-Y).

C= Cu x (Y/Pu + (1-Y))
C= Cu x ((0.3/Pu) + (1-0.3))

Final equation: ***Actual Catch = declared catch x ((0.3/return rate) + 0.7)***

Appendix 4

Resume of changes to Environment Agency rod licence sales and salmon catch returns systems

To 1992: 10 operational regions each managed sales of regional rod licences independently. Sales were predominantly through independent fishing tackle shops and on-fishery outlets. Salmon catch return forms were issued with licences in most regions and were collected in and collated in each region. Only some regions issued reminders.

1992-1993: Licence sales were managed once for all England and Wales. A single licence was issued for angling in all regions and for all species (salmon, trout, freshwater fish and eel). Sales continued through independent fishing tackle shops and on-fishery outlets. Catch return forms were issued to purchasers stating an intention to fish for salmon or sea trout. There was no capacity to issue reminders and salmon anglers could not be separately identified.

1994-1999: The licence system was altered to include a separate licence for fishing for salmon or sea trout (for all England and Wales) and a new single contract for licence sales was established through one principal contractor that controlled 17,000 sales points (Post Office Ltd). Catch return forms could now be targeted to salmon and sea trout anglers and central collation of sales allowed for the issuing of reminders. Initially reminders were issued in January, moving to November in 1995.

2001- 2004: Environment Agency implemented a new database for capture of licence sales information. This improvement allowed for the issuing of two catch return reminders, in November and January that prompted a higher level of reporting.

2005-2007: The licence sales contractor implemented automated capture of sales information with rapid transfer of data to the Environment Agency. This supports more up to date and accurate information on which to base reminders.

2007: The review of the contract to sell rod licences is underway to secure a new contract from 2009. The aim is to seek a cost-effective solution including optimising the opportunity for data capture.

Appendix 5

Example reminder letter

ENVIRONMENT AGENCY

2006 CATCH RETURN REMINDER

Dear Angler,

PLEASE IGNORE If 2006 return already sent

May I remind you that the law requires all salmon licence holders to submit a personal return direct to the Environment Agency giving details of catches and fishing effort as indicated on the attached form. Your return is vital – **please send it as soon as possible;** it is due by 1 January 2007 at the latest.

Thank you for your help.

Dafydd Evans, Head of Fisheries

ROD CATCHES IN 2005

Overleaf is a summary of catches from rivers in England & Wales, with two graphs showing the national catches for 1995 to 2005. Some key statistics from 2005 are:

- 34,082 salmon and sea trout rod licences sold compared with 32,768 in 2004 (4% increase).
- 186,877 days declared fished for salmon and sea trout, compared with 191,200 in 2004, a decrease of 2%.
- 21,418 salmon caught in 2005 (27,236 in 2004).
- 40,219 sea trout caught in 2005 (36,100 in 2004).

Since 15 April 1999, any salmon caught before 16 June must be released under byelaw, but anglers are also voluntarily returning an increasing proportion later in the season, especially larger fish, to help enhance stocks.

- 56% (11,993 fish) of rod caught salmon were released in 2005, the highest release rate recorded to date.
- 59% (23,729) of rod caught sea trout were released, also the highest release rate recorded to date.

Further details can be obtained from: Rob Evans,

The Environment Agency, Cambria House,
29 Newport Road, Cardiff, CF24 0TP

or our web site:

www.environment-agency.gov.uk/fish

Direct Debit

We are now able to offer a paperless direct debit scheme. If you contact 08708 506506 and have your bank details to hand, we will be able to set a direct debit up within a couple of minutes. You can purchase full and concession licences on this scheme, and this will automatically renew every year.

www.environment-agency.gov.uk/subjects/fish

Appendix 6

A review of the estimate currently used to determine the illegal salmon catch for England and Wales

Introduction

The purpose of this report is to review the current estimate used to determine the illegal salmon catch for England and Wales as reported in the annual EA/CEFAS salmon stock assessment report to The International Council for the Exploration of the Seas (ICES) and, if appropriate, to recommend a revised estimate for the 2003 report. It is recognised that by their very nature illegal catches are extremely difficult to quantify, however, the Agency is required to provide a best estimate for ICES purposes (e.g. for models used to determine Pre Fishery Abundance).

Consultation with EA Regional fisheries personnel in 1998 was used as a basis of the current estimate. Regional assessments in 1998 ranged from 5% to 18% of the declared catch. Since 1998 a figure of 12% of the declared catch has been used to estimate the total illegal salmon catch for England and Wales.

Method

Appropriate Area fisheries staff were identified and sent a brief questionnaire in July 2003. Representatives were asked to either agree with the current estimate or to provide a revised estimate together with any justification for their decision. A deadline of 1 October was given to allow time for consultation within Areas.

Results

A summary of Area responses is presented in Table 1. Regional averages together with a national estimate derived from an average of all the regional responses are presented in Table 2. [Please note: the national average excludes Thames and Anglian regions]. Area estimates ranged from 5% (Hants. & Isle of Wight, Southern Region) to 27% (Northern, North West Region – which included an estimate of 50% for SW Cumbria) and Regional estimates ranged from 5% (Southern) to 24% (North West). The national average at 12.6% was 0.6% higher than the 1998 estimate.

Some common issues raised by Areas during the consultation included:-

- salmon by-catch taken by nets targeting bass and other marine species
- resource issues, particularly in areas where salmon stocks are recovering and in areas with many, diverse salmon fisheries
- the opportunistic nature of in-river poaching which remains a problem in many areas (premium paid for wild salmon may be partly driving this).

Discussion and Conclusion

It is recognised that the use of a national average might not be entirely appropriate given the variation in the Regional estimates and the proportion of the England and Wales catch declared by each Region (for example, North West estimate = 24% with

17% of the national catch and Southern Region estimate = 5% with just 1% of the national catch).

Despite the above concern it is recommended that an estimate of 12.6% (rounded up to 13%) of the legal catch is used to determine the illegal catch for 2003. It is also recommended that more novel approaches to determining the illegal catch are investigated and possibly adopted in time for any future review.

Table 1. Summary of illegal catch estimates provided by Area representatives

Region	**Area**	**Estimate (%)**
North East	Ridings	**12**
	Northumbria	**12***
	Dales	**12***
Thames	Tidal	
Southern	Hants; IoW	**5**
South West	Wessex	**12***
	Devon	**12***
	Cornwall	**12**
Midlands	Severn Estuary	**5**
	River Severn	**15**
Wales	South West	**10**
	North	**12***
	South East	**12**
North West	North Cumbria	**20**
	South Cumbria	**12**
	SW Cumbria	**50**
	Central	**12**
	South (Mersey)	

* - no estimate provided, therefore, current 12% assumed acceptable

Table 2 Regional and national estimates of the illegal catch

Region	Illegal catch estimate (%)
North East	12
Southern	5
South West	12
Midlands	10
Wales	11
North West	24
England & Wales	**12.6%**

Rob Evans, National Fisheries Technical Team (20 October 2003)

Appendix 7

Example press article (Trout and Salmon Magazine, December 2005) promoting catch reporting

Vital statistics

ROB EVANS, Environment Agency fisheries scientist, explains how sending in your rod licence catch return data helps in the management of salmon and sea-trout stocks in England and Wales

ANOTHER FISHING SEASON draws to a close, tackle is cleaned and stored away and thoughts turn to what the coming season might bring. Before plans are laid, however, there is one last task to take care of. Details of salmon and sea-trout caught in England and Wales during the season must be reported to the Environment Agency via the rod licence catch return form. Indeed, anglers are legally obliged to submit a return each year. Rivers, days fished, species, dates, weights, methods, and whether or not the fish was released must all be recalled and entered on to the form before it is sent off to the Agency's Warrington office for processing.

For many this is a quick and easy task. The single trip squeezed in during the summer holidays, when the river was too low and the sun too bright can be swiftly dealt with (nil – again!). For the more successful angler, recording the individual details of perhaps 50 or more fish can take a little longer, but perhaps provides a welcome break from writing Christmas cards.

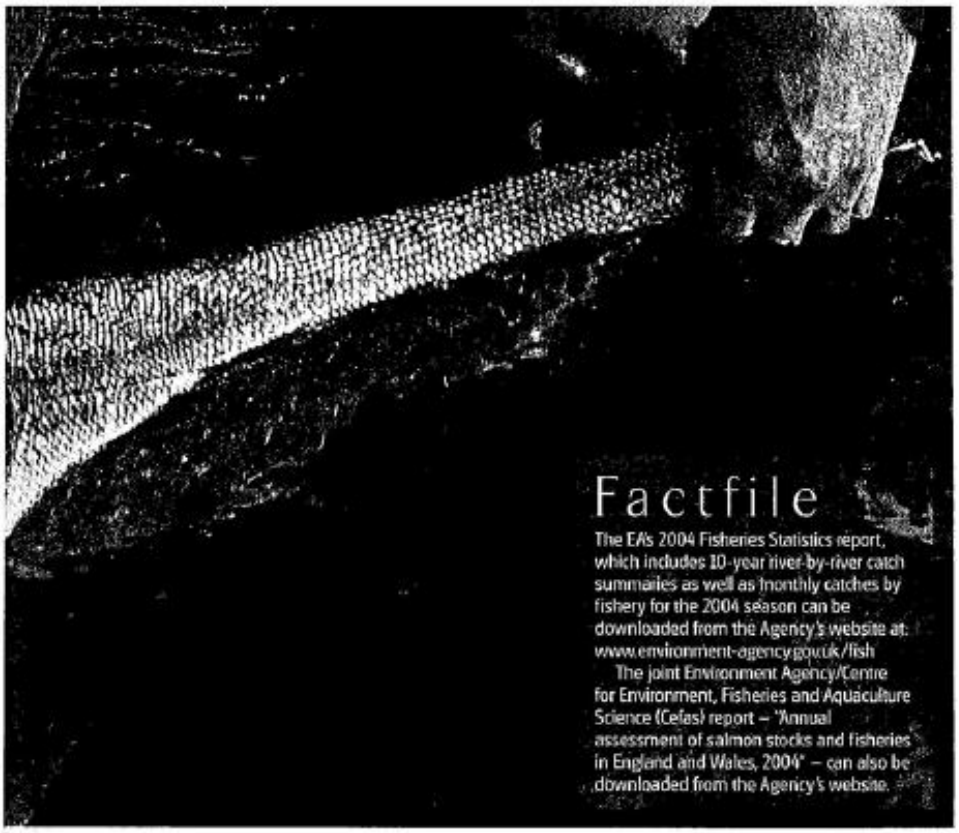
But whether just one or 50 fish have been caught, the Agency needs to know about it. Even if no fish were caught, the number of days fished must be recorded. The amount of fishing that led to a particular level of catch and effort can provide useful insights into stock abundance.

All countries with salmon stocks and fisheries record and use returns in their stock assessments. The Agency takes its role in this respect seriously and is unique in that it issues two postal reminders to all licence holders – one in November and a second one early in the New Year. As a result, approximately 25,000 individual returns are received and processed each year. In an average season, details of 60,000 individual fish will be recorded on to the Agency's Rod Catch database.

Reporting rates are currently estimated at 85 per cent for full licence holders and the Agency is confident that approximately 90 per cent of salmon and sea-trout caught in England and Wales are now reported by anglers, although it recognises that this figure will vary between rivers. Accurate catch statistics are important for many reasons. A number of researchers have demonstrated a statistical relationship between rod catch and stock size (the bigger the run of fish, the bigger the catch), although the relationship can be modified by factors such as flows and fishing effort. Great care must, therefore, be taken when interpreting catch data.

Results from tagging and recapture experiments undertaken on the Welsh Dee since 1992, below, have been used to refine EA stock assessment models.

On some rivers, detailed records go back to the middle of the 19th century, revealing long-term trends in stocks and fisheries performance. Trends in monthly rod catches were important in highlighting the decline in runs of "spring" salmon and were part of the justification behind the introduction of conservation measures in 1999. Numerous authors of books, reports and scientific papers have referred to rod catches over the years to illustrate changes in fisheries in relation to environmental or other influences. Augustus Grimble in his book, *The Salmon Rivers of England and Wales* (1904), recorded catches and licences issued for all the major salmon rivers in England and Wales at the beginning of the 20th century and recognised, even then, the value of maintaining accurate records. Grimble's book remains an important reference to this day. Fisheries managers, academics, angling clubs, river trusts, economists, individual anglers and fisheries owners all have their uses for catch data. The long-term data sets are of huge value now



Factfile

The EA's 2004 Fisheries Statistics report, which includes 10-year river-by-river catch summaries as well as monthly catches by fishery for the 2004 season can be downloaded from the Agency's website at: www.environment-agency.gov.uk/fish

The joint Environment Agency/Centre for Environment, Fisheries and Aquaculture Science (Cefas) report – 'Annual assessment of salmon stocks and fisheries in England and Wales, 2004' – can also be downloaded from the Agency's website.

and will be for coming generations.

The Environment Agency has its own important reasons for ensuring catches are reported as fully and as accurately as possible. Catches are integral to the Agency's annual, river-by-river salmon stock assessments. Electronic fish counts and run estimates derived from annual trapping and tagging studies are, at present, available for only a limited number of rivers. On the remaining rivers, catches form the basis of statistical models used to estimate the number of adult fish returning to spawn each year. The results of these assessments are, in turn, submitted to the International Council for the Exploration of the Seas (ICES), the body responsible for providing scientific advice to the North Atlantic Salmon Conservation Organisation (NASCO).

Assessment methodologies adopted by the Agency are recognised by NASCO and, as well as contributing to our international obligations, are integral to national and local assessments. The Agency, following consultation with interested parties, and in line with Government requirements, has now published Salmon Action Plans (SAPs) for 64 rivers in England and Wales. Each SAP examines stocks and fisheries and sets out a list of actions aimed at improving stocks.

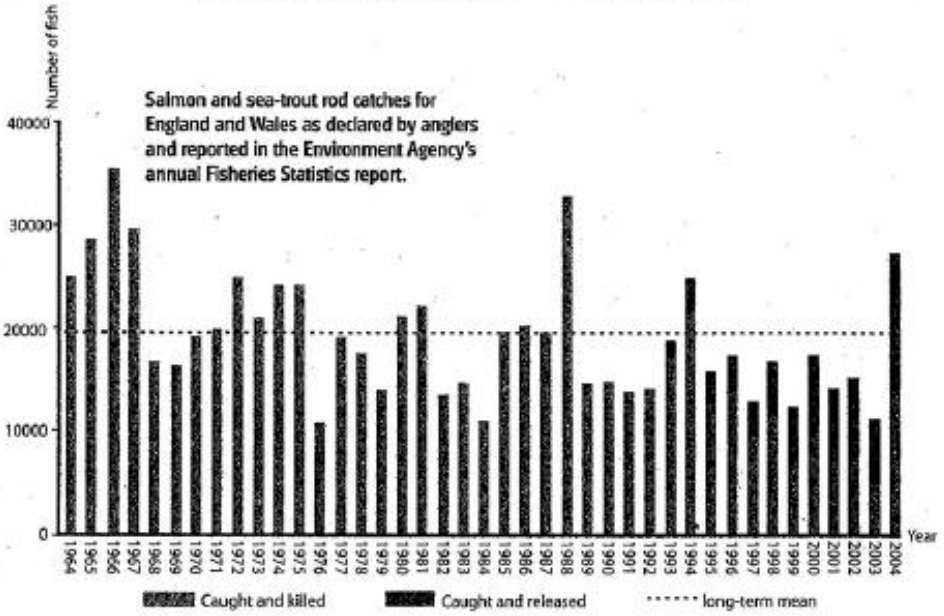
Central to each SAP is the concept of Conservation Limits (CLs). Put simply CLs provide an estimate of the number of spawning fish required to ensure stocks remain sustainable. Each year the Agency assesses compliance (the actual number of spawning fish) against the Conservation Limit and reports the results to ICES. The Agency has developed a computer model utilising the relationship between catchment size and fishing effort to determine the rod-exploitation rate. Once the exploitation rate is known and the declared catch has been corrected for under-reporting (currently by a factor of 1.1), the number of returning fish can be estimated and compliance determined. A compliance failure will trigger appropriate responses.

Salmon, including returned fish like this one, must all be entered on the EA catch return.

It should be pointed out that in addition to rod catches, other factors such as results from juvenile electrofishing surveys and net catches are considered in the overall assessment. In addition, more intensive monitoring is undertaken on a number of index rivers around the country including the Dee (Wales), Lune (North-west), Tyne (North-east) and Tamar (South-west) and results from these studies are used to calibrate the models where possible. Even if resources became available to deploy counters on all rivers, the difficulties of finding suitable sites would exclude their widespread use, so rod catches are likely to continue to play a central role in the assessment process for the foreseeable future. The Agency will continue to improve existing models and subject them to scrutiny by the international scientific community so the best available science is used and errors are minimised.

Plans for 2006 and beyond include refining and improving the current exploitation model by splitting salmon and sea-trout effort. In addition, estimates of under-reporting will be reviewed regularly and steps taken to ensure reporting rates are maximised.

So the message from the Agency is clear. Please don't delay. You must send in your return as soon as possible!



Salmon and sea-trout rod catches for England and Wales as declared by anglers and reported in the Environment Agency's annual Fisheries Statistics report.